



# UNITED STATES PATENT APPLICATION

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Technology Center 2600

TITLE:

Method and Apparatus for Recording Incidents

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## Method and Apparatus for Recording Incidents

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### BACKGROUND OF THE INVENTION

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#### 1. FIELD OF THE INVENTION

This invention generally relates to the field of navigation and recording apparatus. More particularly, this invention relates to digital imaging and audio apparatus used for recording events before, during and after an incident pertaining to a land, sea or air based transportation system.

#### 2. BACKGROUND OF INVENTION

Every few minutes around the country and the world, there is an accident involving a land, sea or air based transportation system. In some cases, there are no survivors or eye-witnesses to give an account of what happened. Even with eye-witnesses or survivors, there are often disputes of the different accounts of what actually happened. As a result, millions of dollars are wasted in lengthy investigations and litigation leading to higher insurance premiums for society. Moreover, unable to accurately determine the cause of an accident, lessons are not learned to prevent future reoccurrence of similar tragedies.

For many years, 'black box' apparatus using audio and electro-mechanical recording means have been deployed on aircraft to provide investigators important clues of what may have occurred before a plane crash. Likewise, 'black box' apparatus using electro-mechanical means can be found near the engines of some land vehicles which record the speed and operator performance data that allows investigators to recreate a profile of what has occurred based on such physical data. However, one of the most valuable forms of evidence, a visual recording of the actual scene within the vicinity of the subject, are often unavailable.

In theory, one can use a security camera or a camcorder to capture the visual scene of an entire trip. In practice, these kinds of recording systems are only suitable for law enforcement purposes as in a police car or inside a building. This is because in the case of law enforcement and security applications, every minute of what has occurred

can be crucial in an investigation. In such applications, there is no way to automatically determine what is important and to just record the portion of the scenario and to skip the rest. However, in the case of accident or incident recording, the general pattern is that only the last few minutes of the record prior to, during and after the accident contain useful information. While capturing a few pictures after an accident has occurred is insufficient and too late, to record scenes of an entire trip is not cost effective and is wasteful because it requires a lot of storage media.

Prior art provided by US 5,596,382 and US 5,568,211 as well as US 5,262,813 disclose of mechanical apparatus able to capture, via a mechanical camera, a road scene upon impact activated by mechanical trigger mechanisms during a car accident. However, these systems relied solely on rigid mechanical capturing means with limited storage capabilities and are not very flexible in the manner they operate and thus cannot be used conveniently to provide the maximum benefit. These prior inventions focused primarily on trigger mechanisms using mechanical means for land vehicles upon impact.

US 5,899,956 disclosed a digital navigation system capable of recording accident scene for land vehicles. Despite~~(of)~~ the fact that the disclosed invention incorporated a mechanism which satisfies the need to automatically capture and preserve the accident scene moments prior to, during and after the occurrence of an accident, it is designed primarily to be used inside a land-based vehicle. What is needed is an apparatus with a narrowed functionality suitable to be used inside a land, sea and air transportation system. In addition, such an apparatus should be able to be used as an external device for monitoring moving transportation systems and to record an incident when it occurs. Examples of such external usage outside of a moving vehicle include roadway intersections, rail-road crossings, underground subway stations. Such an improvement through simplification and generalization is necessary in order to reduce manufacturing cost by allowing the same apparatus to be used in multiple environments for a wider population of the public in the society.

Furthermore, many documented cases of accidents are caused by operators not being alert or awake while operating the vehicles. Therefore, in addition to having forward-looking capability in an accident recording apparatus, it is ~~is~~ <sup>(beneficially)</sup> to

1 provide a backward-looking capability to capture the activities of the operator and the  
2 side and back view of an accident scene.

3 As a modern society that values human lives, the need to be able to have  
4 available visual presentation for safety engineers in preventing future accidents of similar  
5 nature has long been called for. Given the increasing high cost of incident investigation,  
6 liability and litigation, the ability to establish cause, and place fault with viable evidence  
7 is becoming more urgent. What is desperately needed in the society is an incident  
8 recording apparatus that can be manufactured in a cost effective manner capable of  
9 capturing and preserving the actual evidence prior to, during and after an incident  
10 regardless of whether a passenger is riding in a land, sea or air based transportation  
11 system.  
12  
13  
14  
15

## SUMMARY OF THE INVENTION

The present invention is generally directed to satisfying the needs set forth above.

One objective of the invention is to capture the visual scene of an incident so many seconds before, during and after the incident has occurred involving a land vehicle to include a passenger car, bus, van, truck and train.

Another objective of the invention is to capture the visual scene of an incident so many seconds before, during and after the incident has occurred involving a sea-based vehicle to include a speed-boat.

Another objective of the invention is to capture the visual scene of an incident so many seconds before, during and after the incident has occurred involving an air-based transportation system such as a passenger jet.

Another objective of the invention is to capture the activities of the operator of a transportation system so many seconds before, during and after an incident has occurred.

Yet another objective of the invention is to capture the sound wave of an incident so many seconds before, during and after the incident has occurred as a supplement to the visual evidence.

Yet another objective of the invention is to allow the same apparatus to be used as an external monitoring device for recording incidents of moving subjects.

Yet another objective of the invention is to allow the same apparatus to be used as a hand-held device for recording incidents.

Yet another objective of the invention is to reduce the manufacturing cost by allowing the same apparatus to be used in multiple environments for applications having similar patterns.

In accordance with one preferred embodiment of the present invention, the foregoing need can be satisfied by providing a digital incident recording apparatus, comprising: a control unit, 10, for operating the apparatus; a memory unit, 20, for holding computer executable instructions; a persistent memory unit, 30, for providing persistent storage; an imaging capturing unit, 40, for capturing visual scene; a digital sensor, 50, for triggering an automatic preservation of captured scenes, an optional digital audio

recorder, 60, for capturing surrounding sound wave to sync up with the recorded images,  
a power source, 70, to allow for continued operation and, 80, a protective housing.

Other objects and advantages of this invention will become readily apparent as  
the invention is better understood by reference to the accompanying drawings and the  
detailed description that follows.

FIG. 1 is a schematic block diagram showing the essential components of one embodiment of the present invention.

FIG. 2 is a schematic block diagram showing in more detail the essential components of one embodiment of the present invention.

FIG. 3 is a schematic block diagram showing one preferred embodiment of how to preserve a fixed number of images using a finite storage for an unlimited period of time.

FIG. 4 is a schematic block diagram showing another preferred embodiment of how to preserve a fixed number of images using a finite storage for an unlimited period of time.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein are shown preferred embodiments and wherein like reference numerals designate like elements throughout, there is shown in FIG. 1 a schematic block diagram showing the essential components of one embodiment in accordance with the present invention.

As shown in FIG. 1, the digital system comprises: a control unit, 10, for operating the system; a memory unit, 20, for temporarily storage; a forward-looking image capturing unit, 40a, for capturing front view scenes; a backward looking image capturing unit, 40b, for capturing the rear and side view as well as the activities of the operator, 90; a digital sound recorder, 60, for capturing the surrounding sound wave to sync up with the recorded images captured by the imaging unit, 40; a persistent storage, 30, for providing persistent storage of the images captured by the image capturing unit, 40, and sound wave captured by the sound recorder, 60; a power source, 70, to supply the power to allow for continuing operation and a protective housing, 80, to protect the overall construction of the system.

FIG. 2 is a schematic block diagram showing in more detail the essential components of one embodiment of the present invention. It is seen to comprise: an image capturing unit, 40, which can be a CCD or CMOS device; a memory unit 20; a persistent storage 30; a digital sensor, 50, for sensing external events as to trigger the termination of capturing process of images and audio so as to preserve the data in the persistent storage, 30 and a sound recorder, 60 and a control unit, 10, which connects to all major units to provide overall synchronization and operational control.

FIG. 3 is a detailed block diagram showing one preferred embodiment wherein images captured by image capturing unit, 40, are fed into a persistent storage, 30, which has a limited storage capacity made up of N numbers of individual storage cells, 100a, 100b and so on. The captured images are to be stored into each cell in a first-in-first-out fashion such that at any given time, a fixed number of images are to be buffered up representing the consecutive frames of actual scene. With such an arrangement, the latest images captured will replace the earliest images when the last storage cell is reached until such time when the control unit, 10, stops



any further images are inserted into a cell so that the buffered images can be persistently preserved. The number of consecutive images to be preserved is a function of the number of storage cell N. This mechanism is designed to overcome the storage problem associated with the fact that an incident can occur at any time within an unlimited time span, therefore it is essential to have an economical way to selectively preserve only valuable data.

Fig. 4 is another preferred embodiment wherein the captured images are to be first inserted into a volatile memory, 20, and from which the data are then pull into the persistent storage, 30, controlled by the control unit, 10.

It is to be noted that in addition to holding captured images, the persistent storage, 30, along with the storage mechanism as shown in Fig 3 and 4, can be used to hold digital sound (wave) captured by the audio unit, 60. Furthermore, the persistent storage, 30, can be used to hold computer executable instructions and thus replaces or eliminates the memory unit, 20, if so chosen. It is worth to point out that persistent storage, 30, may be substituted by other forms of persistent storage media to achieve a similar result even though most of such persistent storage media tend to have a slower performance. Moreover, the persistent storage, 30, can also be achieved or simulated by (continuously) powering up a volatile memory so as to retain its (contains.) Likewise, the control unit, 10, can be selected from the group consisting of a micro-processor, a micro-controller, a DSP, a PAL, an EPLD, a FPGA and other forms of programmable logic circuits to provide the necessary control functionality.

Although the foregoing disclosure relates to preferred embodiments of the invention, it is understood that these details have been given for the purposes of clarification only. Various changes and modifications of the invention will be apparent, to one having ordinary skill in the art, without departing from the spirit of the invention as hereinafter set forth in the claims.